Weather Note

TORNADOES NEAR NAGS HEAD, N.C., IN MAY AND JUNE 1960

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1. TORNADOES ON MAY 11, 1960

A family of suspended funnel clouds and accompanying pendants was seen at Nags Head on May 11, 1960, between 1520 and 1530 EST. Surface conditions at the time were: wind light and variable, from directions east, south, and west. Shortly after the episode the wind became SSW about 10 m.p.h. and continued thus. Station pressure was 29.82 in. mercury, and rising slowly, temperature 70° F., steady, dew point 56° F., and relative humidity 64 percent. Before the occurrence of the funnels, cumuli moved from the peninsula between Pamlico and Albemarle Sounds and formed into a band, but there was no squall activity or sudden wind or temperature change. The band of cumulus congestus formed nearly overhead in a west-southwest to east-northeast direction and moved along its long axis. No thunder or lightning occurred in connection with these tornado-forming clouds. The congestus clouds in the line formation were not especially massive, and yet a few drops of rain fell from the line at 1445 EST, 35 minutes before the occurrence of these tornadoes. Just after the tornadoes a shower formed a few miles to the west, moved over my location, and gave 0.02 in. of rain. After that the cloud cover diminished. Figures 1, 2, and 3 described in the following discussion were traced from projected color transparencies of these funnels.

During the existence of these tornadoes the base of the cumulus congestus band was rather smooth and straight. There were no waves, bends, roll clouds, or agitation observed here as was seen with an earlier tornado occurrence [1] at Nags Head. The funnel circulations did not extend outward into the associated cloud to any extent and were observed positively only in funnels labeled C and F in figure 1, and D–1 and F in figure 2. Updrafts were also observed with these three vortices which tapered to sharp points. The pendant clouds, labeled B, D, and E, were bulbous in appearance, exhibited downdrafts, but had no rotation. In the time between figures 1 and 2, the vortex D–1 formed to the right of pendant D. In figure 1 seven, and in figure 2 eight, pendants were labeled but the significant feature is the apparent existence of three pairs of pendants (B, C and E, F in fig. 1, and D, D–1 in fig. 2) possibly associated dynamically. Each pair consisted of a twisting, pointed funnel with associated updraft, while by its side (to the left, or northeast) was a bulbous pendant with downdraft. The first pair in

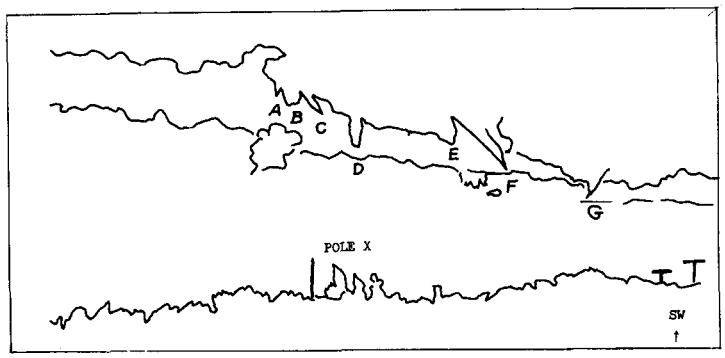

FIGURE 1.—Tornado family at Nags Head, N.C., May 11, 1960, 1520 to 1530 EST. The figure was traced from a projected color transparency. Note vortices C, F, and G, and pendants B, D, and E. Pendant B and vortex C are paired as are E and F.

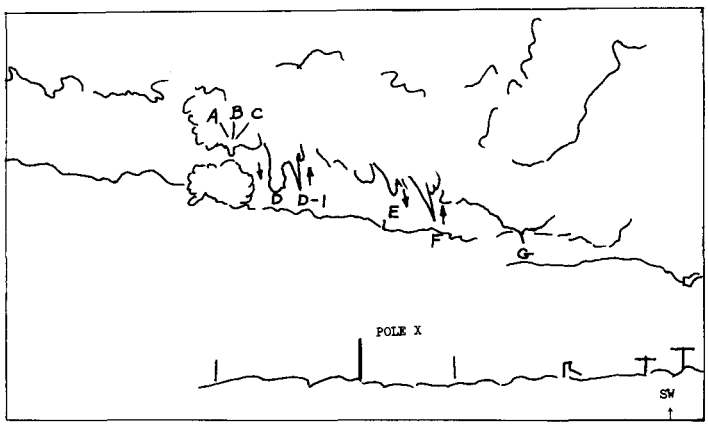

FIGURE 2.—Second traced view of tornado family a few minutes after figure 1. Note the pendant-vortex pairs D and D–1, and E and F. By now, A, B, and C have become one pendant or vortex. Downward motion was associated with D and E, and upward motion and rotation with D–1 and F.

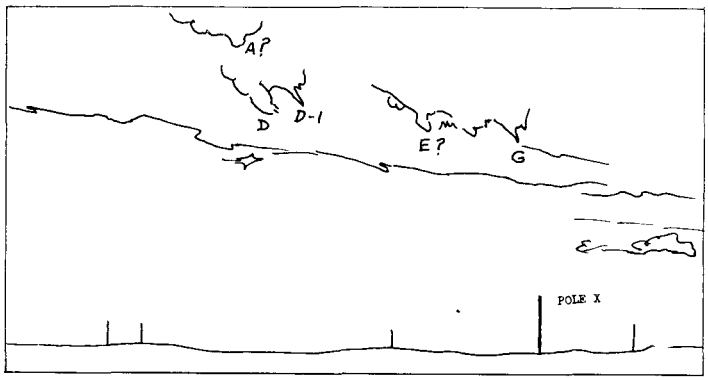

FIGURE 3.—Tornado family 10 minutes after figure 1, again traced from a transparency. Pendant D and paired vortex D–1 remain, pendant E apparently remains, and pendant or vortex G still exists.

[1] Cooperative Weather Observer, U.S. Weather Bureau.

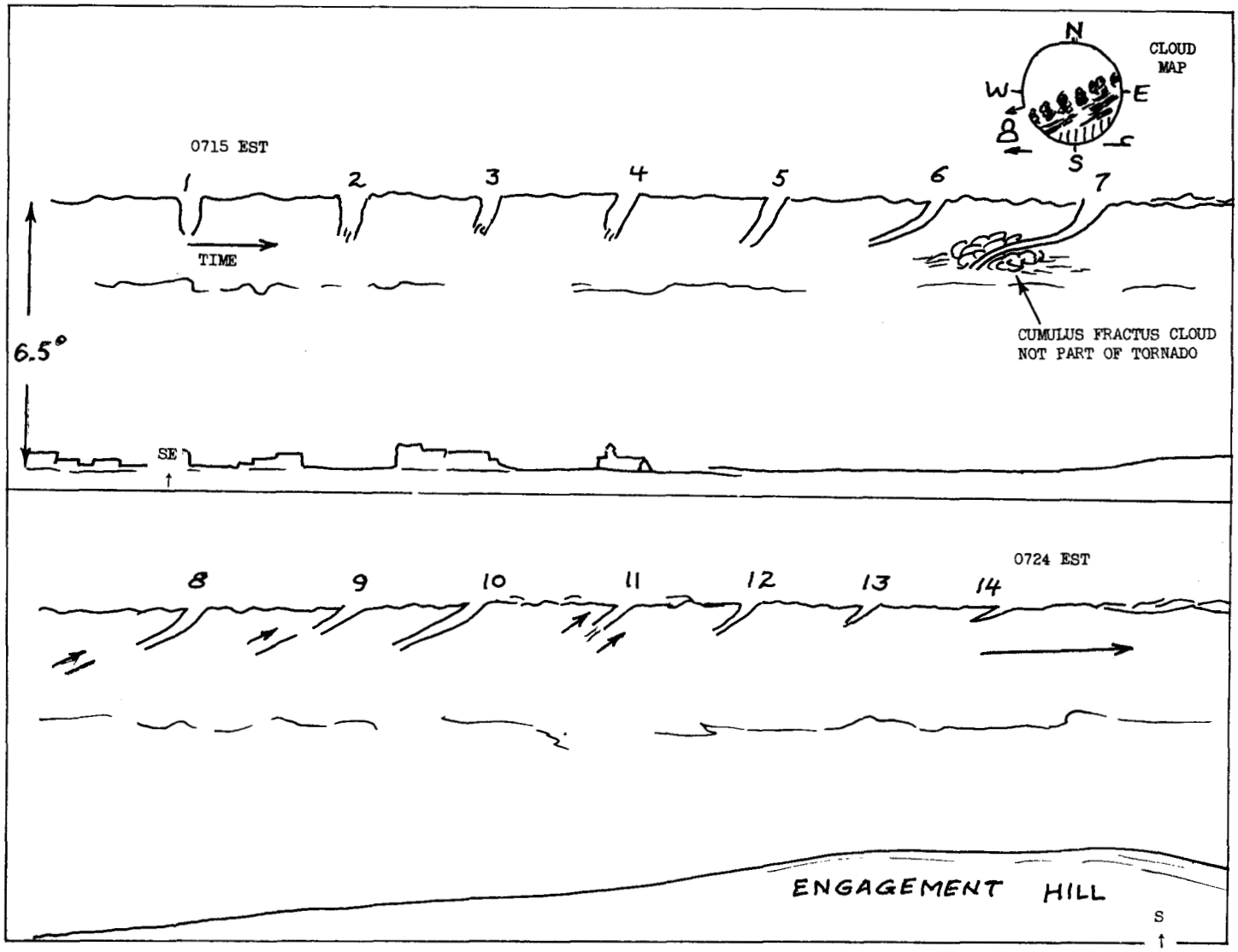

FIGURE 4.—Evolution of tornado-waterspout at Nags Head, June 27, 1960, 0715 to 0724 EST. The detached tip of stage 8 moved toward the main tube and became part of the tornado in stage 10. Along-the-tube motion was observed in stages 8, 9, and 11. The horizontal distance moved by the system was 40° of arc.

figure 1 is B and C and the second pair is E and F, while pendant D had no accompanying vortex in figure 1. Vortex D–1 appeared in figure 2 while pendants A, B, and C had probably degenerated into a single pendant beneath a flat-bottomed cloud. In figure 3, D and D–1 persisted while possibly E and G also remained. Pendant G existed throughout the series of three pictures.

2. TORNADOES ON JUNE 27, 1960

On the morning of June 27 two tornadoes were seen; the first was observed between 0715 and 0724 EST, and was unusual in that it moved from the east-northeast. It occurred in a fairly compact band of cumulus congestus which was oriented west-southwest to east-northeast. The surface wind was northeast 8–10 m.p.h. and the cumulus bases (appearing like cumulus fractus) moved from the east while the cumulus congestus tops moved from east-northeast. These cumulus congestus were not especially massive nor were their tips markedly high. There was no rain, thunder, or lightning, nor any agitation in the bases of these clouds. This incident clearly demonstrates the fact that these smaller tornadoes can and do develop in weather that is not particularly threatening and that no natural warning in the form of thunder necessarily accompanies the vortex.

Most of the lifetime of this tornado was observed through binoculars and the steps of its development are illustrated in the sketches of figure 4. When first seen it was a stubby, broad, and vertical pendant, as in sketch 1, which never reached as much as one-fourth of the way to the earth's surface. The lower end gradually inclined toward the left (trailing portion) without much lengthening until sketch 5, when the cloud tube started to lengthen, bend,

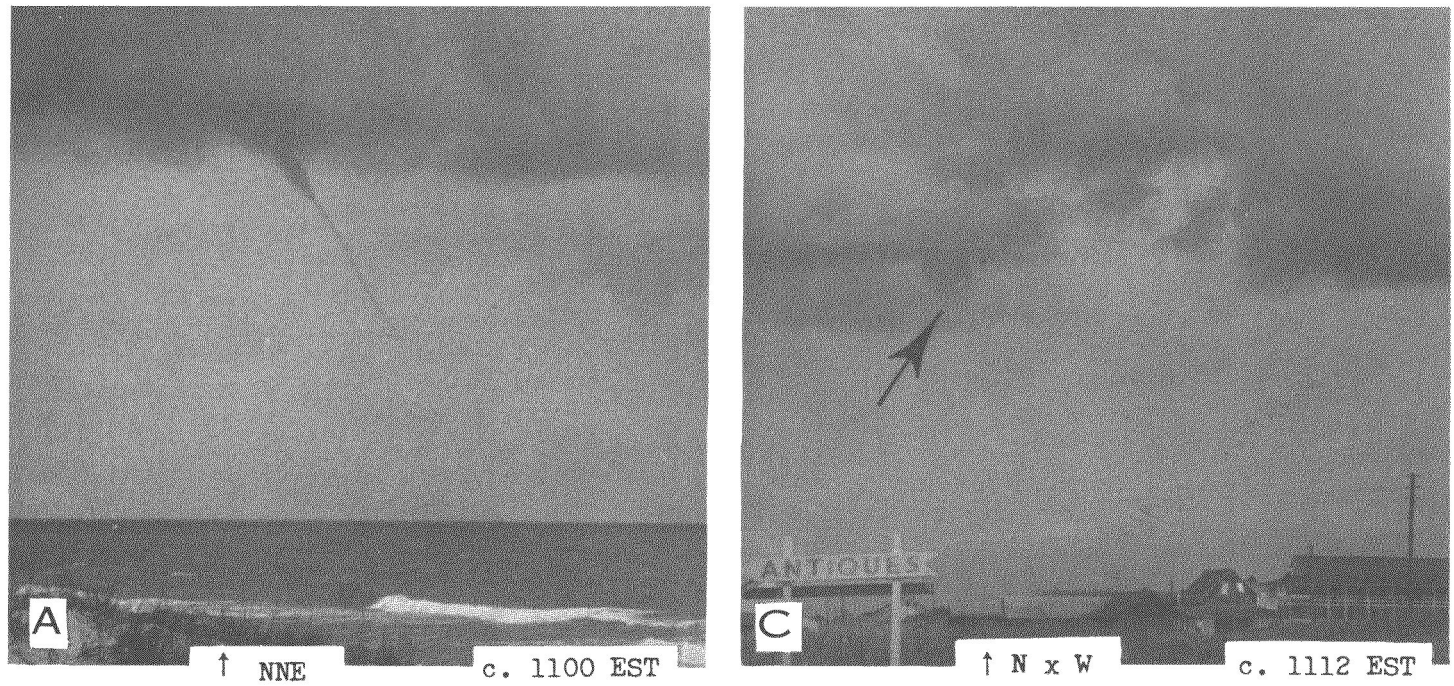

FIGURE 5.—Photographs made 3 miles from the tornado-waterspout of June 27, 1960, from 1100 to 1112 EST. Note the long stinger and slender taper in sections A and B, and the final stubby pendant in section C. Photos by Richard E. Jordan, Nags Head, N.C.

taper, and narrow. In its last two minutes it became gradually shorter and narrower, and as it finally disappeared it was almost horizontal (sketch 14). The funnel was mostly dark and opaque, but in sketch 7 it was light gray in its lower part and showed to advantage against the dark background of cumulus fractus, which latter was not part of the tornado. However, in sketch 10 it was translucent.

The few instances in which an updraft could be observed are marked by short arrows. The apparent movement of the thread-like cloud tube toward the funnel in sketches 8 and 9, which was rather rapid, may have been a growth or lengthening of the tube rather than a movement. But the fact that there was a simultaneous disappearing of the lower end of this tube, though not as fast as the extension of the upper end (resulting in a lengthening of the tube) leads me to think that there was an updraft involved in the movement of the cloud. In sketch 8 the thread-like lower cloud seemed to be along the vortex axis, but it joined the upper edge of the funnel base and immediately the funnel lengthened (sketch 10) with considerable width; it seemed as if the thread-like cloud had been just the higher edge of a fairly thick inclined vortex.

As mentioned above, there was a second tornado on this morning of June 27. It was photographed by Mr. R. E. Jordan who took his first exposure close to 1100 EST, 9½ minutes before I saw it. He was three miles from its nearest approach. His first photograph is reproduced in figure 5A, which shows a slanting funnel with a very long and narrow stinger; no spray bush is visible, but another observer who was in a direct line with the tornado's approach saw a spray bush that broke up when the bush came within a half-mile of the shore. This observer also saw a tube extending all the way from the cloud base to the sea in the early stages, and it appeared that the tornado was lifting water "right up into the sky." Mr. Jordan's second photograph, figure 5B, shows the upper funnel apparently a little longer and the thin stinger a little shorter than earlier.

By 1109:30 EST, I saw this tornado-waterspout and real-

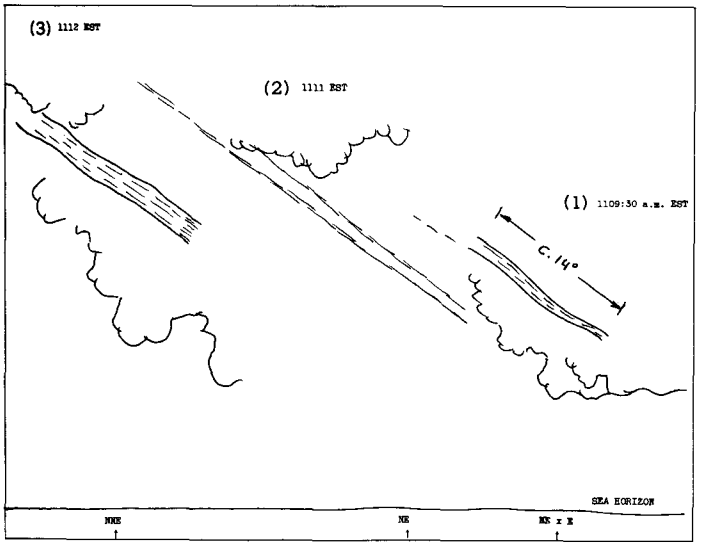

FIGURE 6.—Three stages of the second tornado-waterspout of June 27, 1960, between 1109:30 and 1112 EST, as seen by the author from ½ mile away. Rather than narrowing with time as other tornadoes have done, this tornado became thicker in its trunk portion.

ized that it was much larger than the earlier one. At this time I was about 1 mile from it and could see it in detail. Its direction was from the east in contrast to the usual tornado movement from a westerly direction. In figure 6, are three sequences sketched as I saw them, and these follow the first two pictures taken by Mr. Jordan (fig. 5).

The tornado hung from a fairly large cumulus and its tube was translucent with a double wall beautifully formed. In sketch 2 (fig. 6), at 1111 EST, the tube was very straight and its slope exactly matched the slope of the cloud base into which it extended. In sketch 3, at 1112 EST (nearly the same time as the third picture by Mr. Jordan (fig. 5C)) the tube suddenly grew wider and suddenly dissolved as it was widening. Its width appeared uniform along its length at this time, probably an effect of perspective as the lower end pointed more nearly toward me. At this stage the tube was a smooth gray color, but it grew fainter as it widened, and maintained the appearance of translucence. Instead of disappearing into a level cloud base as it seems in figure 5C, it slanted up along the side of a ragged cumulus, merging slightly with it. Much of the lower tube as I could see it does not show in the picture (fig. 5C) because of an intervening cloud.

The cumulus congestus cloud from which the tornado extended was part of a loosely assembled band or row of cumulus congestus oriented about northeast-southwest. These clouds were not very tall, but had hard edges at the top. Some of the tops had excessively large pileus over them and their color was not white but dirty-looking; they were most likely not frozen. As with the earlier tornado on this day, there was no rain, thunder, or lightning with this larger tornado-waterspout and there was no agitation in the cloud around the funnel or tube, no more than in an ordinary cumulus base. The system seemed to move quite rapidly during the 2½ minutes that I observed it. Surface temperature and dew point were 79° and 66° F., respectively, and the wind gradually changed from northeast to southeast during the morning.

Several people here have reported seeing two funnel clouds southeast of Nags Head at 0500 EST existing simultaneously. This makes a total of 4 known tornadoes or funnels in this vicinity in one morning.

I got the impression that there was an instability line with intermittent cumulus congestus activity along it, which drifted slowly northward during the morning. After the 1100 EST disturbance, the line of cumulus congestus moved to the north, and cumulus humilis became more predominant with only isolated cumulus congestus later, still moving from the east.

The writer hopes that these observations will add to the knowledge of tornadoes in general, and that they can be used by those who are searching for the yet elusive specific cause of these phenomena.

NOTE BY W. H. HOECKER—The importance of the bulbous pendants accompanying the vortices described in figures 1–3 is emphasized by the observation of a similar pendant which accompanied the earlier stage of the Dallas tornado of April 2, 1957, and which was actually larger than the tornado at one time. Figure 2 shows that the pendant at Nags Head accompanying the vortex D–1 was larger than the vortex, but for the two other pairs the vortex appeared larger, at least at the time of the photographs from which the sketches were made.

The importance of the observations for June 27 involves the unusual direction of movement of these tornado-waterspouts from the east and the fact that there was no natural warning to residents in the form of lightning and thunder or associated wind. Also of importance is the shape evolution of the second tornado of June 27. Contrary to a scheme of being short and wide in the early stage and narrowing and lengthening at the late stage, as was characteristic of Great Plains tornadoes investigated by Hoecker [2,3], this tornado was long and slender when first observed and evolved into a short, stubby pendant.

Much is yet to be learned about the inception and evolution of the tornado and it is thought that these observations, by their unusual nature, will point to a generalized concept of tornado formation and life history.

ACKNOWLEDGMENT

The writer is indebted to Mr. Walter H. Hoecker, Jr., of the U.S. Weather Bureau, Washington, D.C., for his excellent suggestions, and his extensive labor in compiling and editing the figures and material in this note.

REFERENCES

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